

DEPARTMENT OF THE AIR FORCE  
WASHINGTON

OFFICE OF THE UNDER SECRETARY  
NRO review completed

March 6, 1965

MEMORANDUM FOR DIRECTOR, [REDACTED]

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SUBJECT: Proposed Boost Glide Device

Your briefing to me on this subject was quite interesting. As you indicated, there are questions, in addition to those of basic technology, which must be addressed in order to get a full evaluation of the possible costs and usefulness of a system based on a boost glide vehicle. I was glad to see that you have already begun to examine some of these. As you point out, a program to exploit the possibilities of a boost glide vehicle will be very expensive, equal in cost to or greater in cost than the development of an advanced airplane. I think that you will agree with me that if a program of this potential size is to survive it must be subjected to analyses of its problems and of the possible alternatives that are complete and of the highest integrity.

Your briefing brought out several conclusions, the most interesting and important of which, in my judgment, were the following.

1. The requirement exists for a flexible rapidly reacting system capable of returning data after a single pass over the target area.
2. A photographic swath 50 miles in width is useful in connection with this requirement.
3. A boost glide trajectory over the area of interest appears a feasible approach to the requirement.
4. Such a trajectory requires about two-thirds of the energy per pound of flight vehicle that is required of an orbital device, making an air launched device appear attractive.

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5. Except in the presence of a major deployment of AICBM defenses, a boost glide trajectory is not highly vulnerable to defensive action.

6. A boost glide system would probably call for a large initial investment, but in an active market might experience relatively low operating costs.

I have several concerns about the proposal as you have now described it. First, it is not clear to me, at all, that a manned vehicle is required, or even desirable, for the mission in question. It seems likely that an unmanned glider for this mission would weigh very much less in flight than the 25,500 lbs. you estimate for the manned vehicle. Its launched weight would then be correspondingly less, and the whole system simpler and possibly cheaper both in development and in operation.

Second, I note that the vehicle you describe, although somewhat different in structural concept, is in size and performance very similar to the X-20 (DYNASOAR), toward the development of which the Government has spent about \$250 million. Any undertaking now to study vehicles of this kind must permit bringing to bear the knowledge gained, and the technology developed, on the X-20. Further, at the present time, the Air Force is studying with the Martin Company a proposed program for an ablatively cooled hypersonic glide vehicle at a somewhat smaller scale. Advantage would result from drawing on this technology as well.

Third, it is not clear to me that a fully integral, completely recovered, single stage boost is the best for this mission. In particular, a smaller vehicle, properly staged at boost, might not require development of a new propulsion system.

Fourth, it is quite clear to me that a program of the size and scope of that visualized in your briefing cannot practicably be carried out in a clandestine manner. Should it develop that the scope of the program cannot significantly be reduced by simplification of the vehicle and of its propulsion requirements,

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it will be necessary for the NRO to manage the program in such a way that major elements can be covered by overt identification and financing.

Finally, we must recognize, as your briefing already has, that a boost glide system is in potential competition with ~~satellite and ballistic systems~~. These could be available sooner than a boost glide system of the kind described in your briefing, or alternatively they could be of a generation later than systems now in operation or development. If configured against the now recognized requirement for quick reactions, these competitors would have operational characteristics, and costs, requiring careful comparison with those of a boost glide device.

In view of your conclusions, I agree that proper consideration must be given to a boost glide system. In view of my concerns, and because of the potential cost of any final program that might result, I feel that I cannot recommend even initial steps to the Secretary of Defense and to the Director of Central Intelligence until I am satisfied that two conditions can be met:

First, that a program can be laid out that provides the DNRO, and thus also the Secretary of Defense and the Director of Central Intelligence with a full and objective comparative analysis of all competing means that might reasonably satisfy the requirement stated;

Second, that financial commitments and obligations to contractors during the program can at all times be limited to those which in the judgment of the DNRO are justified by their expected contribution toward the achievement of approved goals.

Accordingly, I would like you to lay out for my consideration a program along the following lines.

The interest is in a boost glide vehicle, air launched from a carrier no larger than a B-52, and capable of a useful trajectory of 6000 nautical miles or more. Competitive paid

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vehicle design studies would be undertaken with at least two contractors, McDonnell and Boeing, and preferably also with Martin. These design studies would proceed in two steps. For each contractor, the objective of the first step would be to examine alternative configurations in sufficient detail that each contractor's preferred configuration or configurations would be identified. The objective of the second step would then be to pursue design studies of the preferred configurations in sufficient detail that effective evaluations and comparisons can be made among the designs of the competing contractors. Comparisons in all cases are to be made on the basis of weights, costs (both development and operating), mission performance, possible operational limitations, and factors bearing on operational reliability and development risk.

Initially, consideration must be given by each contractor to at least the following four general configurations.

- 1) Manned vehicle with integral booster,
- 2) manned second stage vehicle with a disposable first stage,
- 3) and 4): unmanned vehicles, respectively with integral and separable boosters.

In considering vehicles with separable boosters, an optimally staged configuration should be identified; consideration must also be given, however, to disposing of the first stage within 300 nautical miles of the launch point.

For the first step, all vehicle contractors would be given the same interface requirements for the camera system.

For each contractor, the output of the first step would consist of at least the following:

1. Preliminary aerodynamic data permitting initiation of camera window studies, to be done under other contracts.

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2. Comparative analysis of the configurations studied carried to the point for each that further study or rejection can be justified. For the more likely or attractive configurations, some indication should be given of the sensitivity of each to the constraints imposed by the camera interface.

3. One or more recommended preferred configurations, with justification.

I would expect you to submit your recommendations for those configurations to be carried into the second step, with justification, for my review and approval.

Each contractor, during the second step, would concentrate on the configurations approved to him. Arrangements would be made at this time with propulsion contractors, as necessitated by the particular configurations under study. For each vehicle contractor the output of the second step should include an overall system concept, and a vehicle design or designs in sufficient detail that specific structural techniques, specific propulsion requirements and subsystems, and recommended other subsystems are identified. Analyses should be presented permitting comparisons among competitors according to the criteria listed earlier.

At or near the close of the second step, it would be necessary for the NRO to convene a panel to examine the structural, propulsion, and other problems associated with each proposed vehicle system. Using the results of the second step, the findings of this panel, and the results of such other analyses as the NRO will make, the DNRO would then report to the Secretary of Defense and the Director of Central Intelligence. Were the findings to justify it, such a report could recommend the initiation of a program definition phase, with vehicle and propulsion contractors to be selected by such procedures as might appropriately be recommended at that time.

There is little question that the cost and time to develop a boost glide system will be dominated by the problems of the vehicle itself. Nevertheless, should a program definition phase

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be undertaken, it will be necessary to include definitive work by a camera contractor. Accordingly, it is appropriate, at about the close of the first step of the vehicle studies, to invite three or four camera contractors to compete in a paid design competition for selection of a camera design and contractor. Prior to that time, additional study is needed of the camera requirements, and of the relation of these requirements to those that might be imposed by a ballistic system configured for comparable missions.

Please let me have your recommendations for a study program conforming to the objectives and guidance just outlined.

[Redacted]  
Brockway McMillian  
Director  
National Reconnaissance Office

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